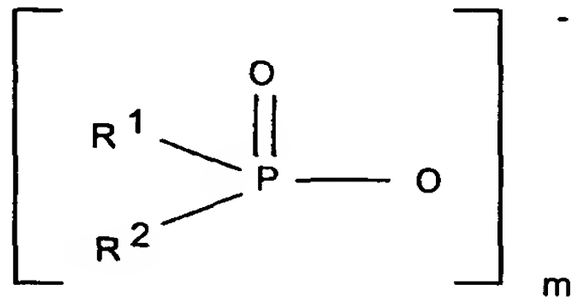
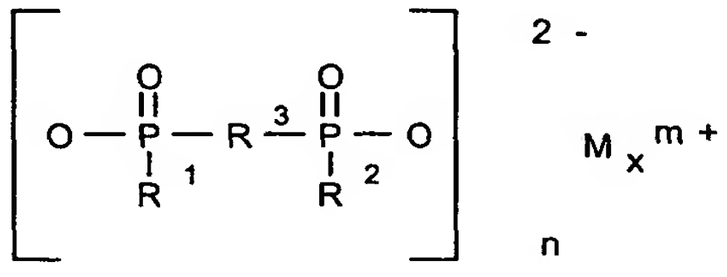
Patent claims

1. A pulverulent flame-retardant composition with low dust level, composed of an organophosphorus flame retardant component, and of at least one dust-reduction additive.

2. The pulverulent flame-retardant composition with low dust level, as claimed in claim 1, wherein the organophosphorus flame-retardant component is a phosphinic salt of the formula (I) and/or a diphosphinic salt of the formula (II) and/or polymers of these (component A),



(I)



(II)

where

R^1 and R^2 are identical or different and are C_1-C_6-alkyl, linear or branched, and/or aryl;

R^3 is C_1-C_{10}-alkylene, linear or branched, C_6-C_{10}-arylene, -alkylarylene, or -arylalkylene;

M is Mg, Ca, Al, Sb, Sn, Ge, Ti, Zn, Fe, Zr, Ce, Bi, Sr, Mn, Li, Na, K, and/or a protonated nitrogen base;

m is from 1 to 4;

n is from 1 to 4;

x is from 1 to 4.

3. The pulverulent flame-retardant composition with low dust level, as claimed in claim 1 or 2, wherein M is calcium, aluminum or zinc.

4. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 3, wherein R^1 and R^2 are identical or different and are C_1-C_6-alkyl, linear or branched, and/or phenyl.

5. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 4, wherein R^1 and R^2 are identical or different, and are methyl, ethyl, n-propyl, isopropyl, n-butyl, tert-butyl, n-pentyl, and/or phenyl.

6. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 5, wherein R^3 is methylene, ethylene, n-propylene, isopropylene, n-butylene, tert-butylene, n-pentylene, n-octylene, or n-dodecylene; phenylene or naphthylene, methylphenylene, ethylphenylene, tert-butylphenylene, methylnapthylene, ethylnaphthylene, or tert-butylnaphthylene; phenylmethlene, phenylethylene, phenylpropylene, or phenylbutylene.

7. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 6, wherein the composition and/or the organophosphorus flame-retardant component also comprise(s) melamine phosphate, dimelamine phosphate, melamine pyrophosphate, melamine polyphosphates, melam polyphosphates, melem polyphosphates, and/or melon polyphosphates.

8. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 7, wherein the composition and/or the organophosphorus flame-retardant component also comprise(s) melamine condensation products, such as melam, melem, and/or melon.

9. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 8, wherein the composition and/or the organophosphorus flame-retardant component also comprise(s) oligomeric esters of tris(hydroxyethyl) isocyanurate with aromatic polycarboxylic acids, benzoguanamine, tris(hydroxyethyl) isocyanurate, allantoin, glycoluril, melamine, melamine cyanurate, dicyandiamide, and/or guanidine.

10. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 9, wherein the composition and/or the organophosphorus flame-retardant component comprise(s) nitrogen-containing phosphates of the formulae $(NH_4)_y H_{3-y} PO_4$ and, respectively, $(NH_4 PO_3)_z$, where y is from 1 to 3 and z is from 1 to 10 000.

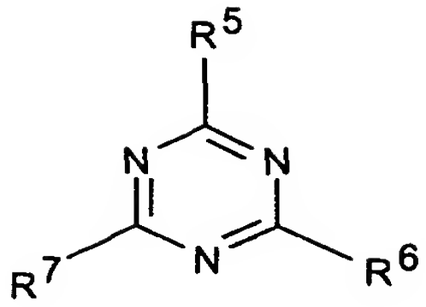
11. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 10, wherein the composition and/or the organophosphorus flame-retardant component comprise(s), as component B, a synthetic inorganic compound and/or a mineral product.

12. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 11, wherein component B is an oxygen compound of silicon, is magnesium compounds, is metal carbonates of metals of the second main group of the Periodic Table, is red phosphorus, is zinc compounds, or is aluminum compounds.

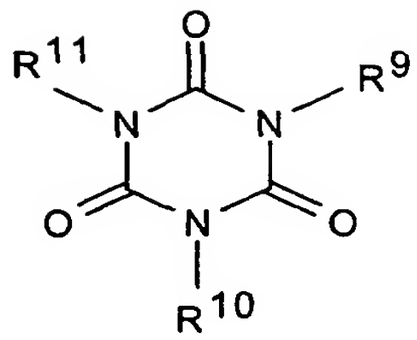
13. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 12, wherein the oxygen compounds of silicon are salts and esters of orthosilicic acid and condensation products thereof, are silicates, zeolites, and silicas, are glass powder, glass/ceramic powder, or ceramic powder; the magnesium compounds are magnesium hydroxide, hydrotalcites, magnesium carbonates, or magnesium calcium carbonates; the zinc compounds are zinc oxide, zinc stannate, zinc hydroxystannate, zinc phosphate, zinc borate, or zinc sulfides; the aluminum compounds are aluminum hydroxide or aluminum phosphate.

14. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 13, wherein the composition and/or the organophosphorus flame-retardant component comprise(s) nitrogen compounds as further component C.

15. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 14, wherein the nitrogen compounds are those of the formulae (III) to (VIII) or mixtures thereof



(III)



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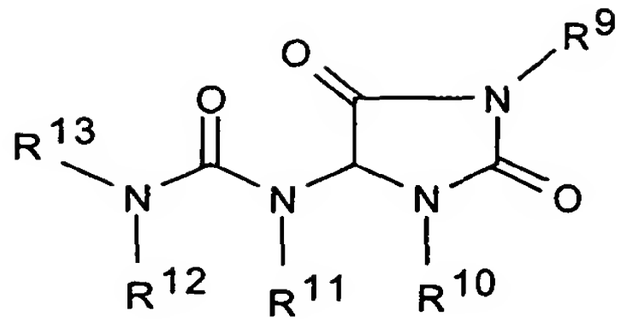

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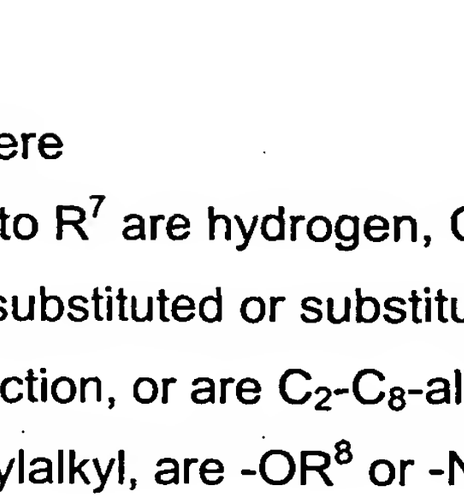

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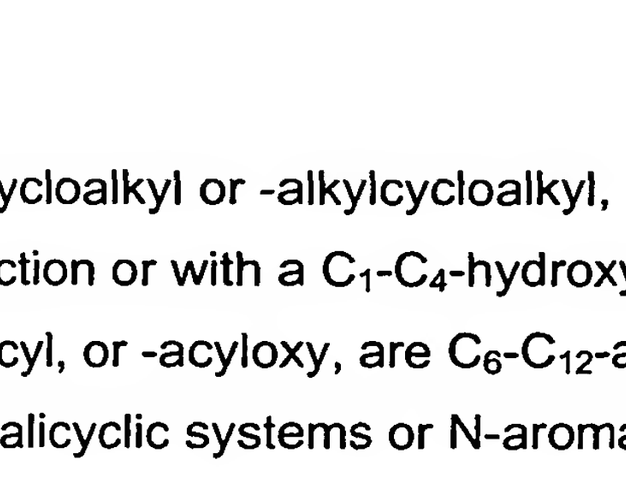

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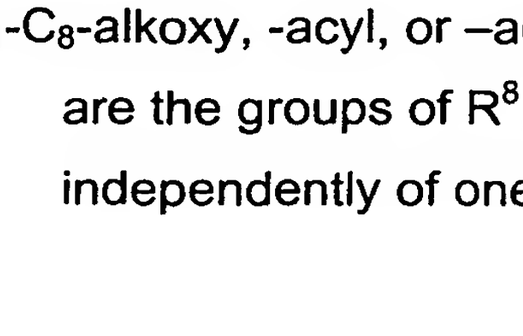

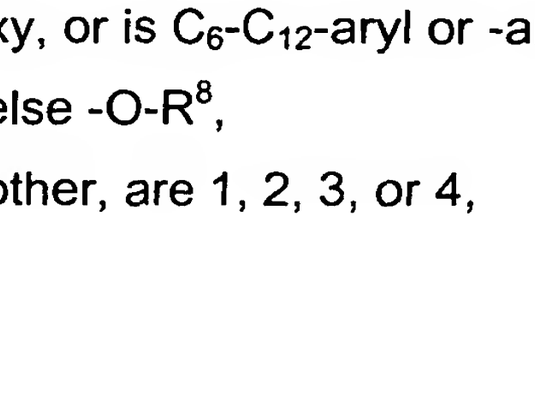

(VIII)

where

10 R^5 to R^7 are hydrogen, C_1-C_8-alkyl, or C_5-C_{16}-cycloalkyl or -alkylcycloalkyl, unsubstituted or substituted with a hydroxy function or with a C_1-C_4-hydroxyalkyl function, or are C_2-C_8-alkenyl, C_1-C_8-alkoxy, -acyl, or -acyloxy, are C_6-C_{12}-aryl or -arylalkyl, are -OR^8 or -$N(R^8)R^9$, or else are N-alicyclic systems or N-aromatic systems,

15 R^8 is hydrogen, C_1-C_8-alkyl, C_5-C_{16}-cycloalkyl or -alkylcycloalkyl, unsubstituted or substituted with a hydroxy function or with a C_1-C_4-hydroxyalkyl function, or is C_2-C_8-alkenyl, C_1-C_8-alkoxy, -acyl, or –acyloxy, or is C_6-C_{12}-aryl or -arylalkyl,

R^9 to R^{13} are the groups of R^8, or else -O-R^8,

m and n, independently of one another, are 1, 2, 3, or 4,

X is acids which can form adducts with triazine compounds (III).

16. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 15, wherein the composition and/or the organophosphorus flame-retardant component also comprise(s) carbodiimides.

17. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 16, wherein the dust-reduction additive comprises alkylalkoxylates having from 8 to 22 carbon atoms and from 1 to 80 EO units per mole of alcohol.

18. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 16, wherein the dust-reduction additive comprises paraffin oils and/or mineral oils with boiling points above about 360°C, soft paraffin wax with a melting point of from about 38 to 60°C, fully refined paraffin waxes with melting points of from about 60 to 62°C, and/or chlorinated paraffin oil, with a chlorine content of 70%, and with a viscosity of 1 200 centipoise.

19. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 16, wherein the dust-reduction additive comprises silicone oils with molar masses of from 1 000 to 150 000 g/mol and viscosities of from 10 to 1 000 000 mPas; halogen-substituted silicones, or functionalized silicones; methylphenylpolysiloxanes, or copolymeric siloxanes; castor oil, glycerol, di-2-ethylhexyl phthalate, or polyesters of phthalic acid; aromatic and aliphatic esters of phosphoric acid, or else anionic polyester polyurethanes; ethylene glycol, propylene glycol and/or butylene glycol, their oligomers and/or polymers, and/or their ethers.

20. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 16, wherein the dust-reduction additive comprises naturally occurring, chemically modified, and/or synthetic waxes, preferably carnauba waxes and montan waxes.

21. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 20, which has a median particle size of from 0.1 to 1 000 µm, preferably from 1 to 100 µm.

22. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 21, which has an average bulk density of from 80 to 800 g/l, preferably from 200 to 700 g/l.

23. The pulverulent flame-retardant composition with low dust level, as claimed in one or more of claims 1 to 22, wherein the ratio of amount of dust-reduction additive to that of organophosphorus flame-retardant component is from 1:999 to 1:4, preferably from 1:99 to 1:19.

24. A process for preparing pulverulent flame-retardant compositions with low dust level, as claimed in at least one of claims 1 to 23, which comprises emulsifying the dust-reduction additive in water and then adding this emulsion to an aqueous suspension of the organophosphorus flame-retardant component, and stirring at from 20 to 200°C for from 0.1 to 100 hours, removing the solid, washing with water, and then drying.

25. A process for preparing pulverulent flame-retardant compositions with low dust level, as claimed in at least one of claims 1 to 23, which comprises adding, in a suitable mixer, the dust-reduction additive in liquid form to the organophosphorus flame-retardant component, which has been set in motion, and mixing at from 20 to 200°C for from 0.1 to 100 hours, and then drying at from 20 to 400°C.

26. A process for preparing pulverulent flame-retardant compositions with low dust level, as claimed in at least one of claims 1 to 23, which comprises adding, in a suitable mixer, the solid dust-reduction additive to the organophosphorus flame-retardant component, which has been set in motion, mixing for from 0.1 to 100 hours, and during that process heating to the melting point of the dust-reduction additive.

27. A flame-retardant polymer molding composition, which comprises a pulverulent flame-retardant composition with low dust level, as claimed in at least one of claims 1 to 23.

28. The flame-retardant polymer molding composition as claimed in claim 27, which comprises
from 1 to 50% by weight of pulverulent flame-retardant composition with low dust level,
from 1 to 99% by weight of thermoplastic polymer or a mixture of the same
from 0 to 60% by weight of additives
from 0 to 60% by weight of filler.

29. The flame-retardant polymer molding composition as claimed in claim 27 or 28, which comprises
from 5 to 30% by weight of pulverulent flame-retardant composition with low dust level,
from 5 to 90% by weight of the thermoplastic polymer or a mixture of the same
from 5 to 40% by weight of additives
from 5 to 40% by weight of filler.

30. The flame-retardant polymer molding composition as claimed in one or more of claims 27 to 29, which also comprises components B and/or C.

31. The flame-retardant polymer molding composition as claimed in one or more of claims 27 to 30, wherein the thermoplastic polymers are HI (high-impact) polystyrene, polyphenylene ethers, polyamides, polyesters, polycarbonates, or blends or polyblends of the type represented by ABS (acrylonitrile-butadiene-styrene), or PC/ABS (polycarbonate/acrylonitrile-butadiene-styrene).

32. The flame-retardant polymer molding composition as claimed in one or more of claims 27 to 31, wherein the thermoplastic polymers are polyamide, polyester, or ABS.

33. A polymer molding, a polymer film, a polymer filament, or a polymer fiber, comprising a pulverulent flame-retardant composition with low dust level as claimed in at least one of claims 1 to 23.

34. A polymer molding, a polymer film, a polymer filament, or a polymer fiber as claimed in claim 33, wherein the polymer is a thermoplastic or thermoset polymer.

35. A polymer molding, a polymer film, a polymer filament, or a polymer fiber as claimed in claim 33 or 34, wherein the thermoplastic polymers are HI (high-impact) polystyrene, polyphenylene ethers, polyamides, polyesters, polycarbonates, or blends or polyblends of the type represented by ABS (acrylonitrile-butadiene-styrene), or PC/ABS (polycarbonate/acrylonitrile-butadiene-styrene), polyamide, polyester, and/or ABS.

36. A polymer molding, a polymer film, a polymer filament, or a polymer fiber as claimed in claim 33 or 34, wherein the thermoset polymers are formaldehyde polymers, epoxy polymers, melamine polymers, or phenolic resin polymers, and/or polyurethanes.

37. A polymer molding, a polymer film, a polymer filament, or a polymer fiber as claimed in one or more of claims 33 to 36, which comprises
from 1 to 50% by weight of pulverulent flame-retardant composition with low dust level,
from 1 to 99% by weight of polymer or a mixture of the same
from 0 to 60% by weight of additives
from 0 to 60% by weight of filler.

38. A polymer molding, a polymer film, a polymer filament, or a polymer fiber as claimed in one or more of claims 33 to 37, which comprises
from 5 to 30% by weight of pulverulent flame-retardant composition with low dust level,
from 5 to 90% by weight of polymer or a mixture of the same
from 5 to 40% by weight of additives
from 5 to 40% by weight of filler.